

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-346448

(43)Date of publication of application : 14.12.1999

(51)Int.Cl.

H02K 3/04

H02K 3/28

(21)Application number : 11-139950

(71)Applicant : DENSO CORP

(22)Date of filing : 20.05.1999

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(30)Priority

Priority number : 11999999
09279751Priority date : 26.05.1997
26.09.1997

Priority country : JP

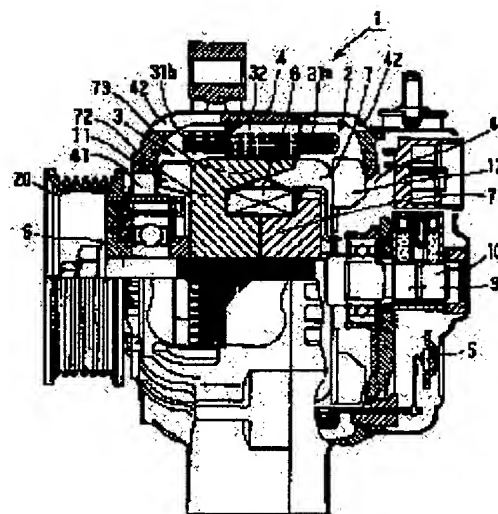
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(54) STATOR OF AC GENERATOR FOR VEHICLE

(57)Abstract:

PROBLEM TO BE SOLVED: To secure a necessary number of turns for one slot with a small number of turns by forming a stator winding by jointing, a plurality of segments, each of which is constituted of fundamental segments of regular shapes and segments having a different shape from that of the fundamental ones.

SOLUTION: A stator winding is formed by jointing a plurality of segments which are constituted of electrical conductors. These segments are constituted of fundamental segments of a regular shape and segments having a different shape from that of the fundamental ones. The fundamental segments form a first group 31a of coil ends on one side of an end face in the axial direction of a stator iron core 32 and a second group 31b of coil ends on the other side of the end face. The segments having a different shape form an extraction line of the stator winding and a turn section connecting a first and a second turn. Due to this structure, a necessary number of turns per slot can be secured with a small number of turns.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the
examiner's decision of rejection or application converted
registration]

[Date of final disposal for application]

[Patent number]

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CLAIMS

[Claim(s)]

[Claim 1] The stator of the AC generator for vehicles which has the stator core with two or more slots and the stator winding of the polyphase with which the aforementioned slot was equipped which are characterized by providing the following. Two or more segments which consist of an electric conductor are joined, it is constituted, and, for the aforementioned segment, the aforementioned stator winding is the basic segment of a regular configuration. Consisting of an aforementioned basic segment and a variant segment which differs in a configuration, the aforementioned basic segment is the turn section.

[Claim 2] The 1st coil of the above and a group are the stator of the AC generator for vehicles according to claim 1 which arranges so that the turn section of other segments may surround the turn section of the segment of 1, and is characterized by the bird clapper.

[Claim 3] The stator of the AC generator for vehicles according to claim 1 or 2 characterized by arranging even electric conductors which make four the minimum only in the direction of a path into the aforementioned slot.

[Claim 4] The joint in the 2nd coil of the above and a group is the stator of the AC generator for vehicles according to claim 3 characterized by being arranged annular [four-fold / 3-fold / a duplex and / and].

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the stator of the AC generator for vehicles which can be carried in vehicles, such as vessels, such as a passenger car and a truck, about the AC generator driven with an internal combustion engine.

[0002]

[Description of the Prior Art] In the coil process of the stator of the AC generator for vehicles, there is the method of constituting a coil by the insertion process to the slot of a stator and junction of segments using the segment which consists of an electric conductor of a large number (this crooked portion is hereafter called the turn section) beforehand crooked in the shape of a hairpin not using a successive line. Since there are many junction parts, in order to reduce a manufacturing cost with this composition, automation of a junction process was indispensable.

[0003] The composition of a publication is known by the international public presentation 92/06527 as a stator of the AC generator for vehicles using the segment. The joint of segments is annularly arranged in one side of a stator core, and the composition make junction by soldering or welding easy to automate is proposed by the international public presentation 92/06527. According to the composition shown here, four segments are arranged in a slot, the segment corresponding to each reversal connection and middle connection of a coil is created individually beforehand, and the stator winding is formed by joining these.

[0004]

[Problem(s) to be Solved by the Invention] In the international public presentation 92/06527, the wave winding is formed in an outer layer [within one slot], and inner layer side like drawing 21 using the segment arranged two [at a time]. The coil specification view for one phase is shown in drawing 20 . Here, the number on a par with the central horizontal single tier of drawing expresses the slot number. Moreover, the solid line of drawing 20 expresses the electric conductor inserted in the position of A of drawing 21 , and a dashed line expresses similarly the electric conductor with which B and a two-dot chain line are inserted in C, and the dashed line is inserted in the position of D.

[0005] Two or more basic segments 105 with the same length and the same configuration are contained in two or more segments which constitute this coil. This basic segment 105 is arranged so that the two bays may be located in basic 1 pole-pitch remote slot, respectively. And two or more basic segments are arranged regularly, and a series of coils are formed by being joined regularly.

[0006] However, in this coil, since four electric conductors are held in one slot, the wave-winding coil which carries out a stator core 4 round is formed. For this reason, in order to carry out the series connection of the wave-winding coil of each periphery, the variant segment of a configuration which is different in a basic segment 105 is used. In this coil, the variant segment 102 which connects the variant segment 101 which connects the 3rd round with the 100 or 2nd round of the variant segment which connects the 2nd round with the 1st round and the 3rd round, and the 4th round is used.

[0007] Furthermore, in order to form two leader lines X1 and X2 as an outgoing end of a coil, two variant segments 103 and the variant segment 104 are used.

[0008] Therefore, in the coil of this conventional technology, in order to form the coil of one phase, a total of five variant segments are needed.

[0009] And in this coil, 1 pole-pitch detached building ***** of the two leader lines X1 and X2 is carried out. Since both the leader lines X1 and X2 are electric conductors arranged at the outer layer side of a slot, they are required for this in order to avoid interference with the basic segment of other Y phases and Z phase.

[0010] As mentioned above, in the coil of the conventional technology, in order to form the coil of one phase, at least five variant segments are needed. This can be explained as follows. In the international public presentation 92/06527,

the coil which makes it a coil and carries out the surroundings of a stator core 4 round is formed by inserting four segments in the slot of one stator core, and connecting by the connection 106.

[0011] The insertion process of the segment for forming the annular coil ring which carries out the surroundings of a stator core 1 round, and the junction process of a segment edge are the same about all segments. The coil for 2 round is already formed in a pan about the same slot as the above-mentioned slot by the coil for another loop winding for 1 round, and the above-mentioned 2 round, and 3 slot staggering ***** , and the annular coil for a total of 4 rounds is formed.

[0012] In order to use as one coil the annular coil which carries out the surroundings of this stator core 4 round, it is necessary to cut about each ring by one place (for them to be a total of four places at four rings), and to connect with the cutting section of other rings. A variant segment is needed the two totals [five] which have 3 have a connection with other rings, and the drawer section as an outgoing end.

[0013] Can concentrate these five variant segments and they cannot be prepared in the coil end between basic 1 pole pitches. A heavy bird clapper is because there is nothing at the coil end to which the annular coil for 4 round was divided into 2 sets from which the position shifted by three slots mutually as mentioned above, and four rings are located in a line in the direction of a path.

[0014] Of course, if the segment per slot is made into two of the half of the above-mentioned example, it is possible to centralize a variant segment on the coil end between 1 pole pitches. However, in having reduced the number of turns per slot, the output in a low-speed rotation region required as an AC generator for vehicles is not fully securable.

[0015] With the composition shown in this drawing 20 , the electric conductor which came out of the inner layer side, and the electric conductor which came out of the outer layer side are joined by the joint 106. Therefore, by the inner layer and outer layer side, the electric conductor which came out of each slot inclines in the same direction altogether, and the electric conductors which came out of the adjacent slot do not interfere each other in it.

[0016] Moreover, in the stator winding of the international public presentation 92/06527, since it is arranged in one side of a stator core annular [one], if especially the physique of a stator becomes small, the distance of joints will approach and, as for a joint 106, a junction process will become difficult.

[0017] As mentioned above, since the attachment process to the stator core of a segment becomes complicated and a manufacturing cost becomes high by the increase in a variant segment, and reduction of a joint interval, the original purpose cannot be attained.

[0018] Moreover, in the international public presentation 92/06527, there is a publication of the purport that a stator winding can be made into a lap winding (loop volume) using a segment. However, the publication which is the grade which can carry out the lap winding which used the segment is not carried out to the international public presentation 92/06527.

[0019] this invention aims at offering the stator which secures the number of turns per slot with the few number of the circumference.

[0020] this invention is made in view of the trouble of the above-mentioned conventional technology, and aims at offering the stator which makes easy the coil process which used the segment.

[0021] In detail, this invention offers a stator with few unique segments, securing the number of turns per slot.

[0022]

[Means for Solving the Problem] In the stator of the AC generator for vehicles which has the stator core in which a claim 1 has two or more slots, and the stator winding of the polyphase with which the aforementioned slot was equipped the aforementioned stator winding Two or more segments which consist of an electric conductor are joined, and it is constituted. the aforementioned segment It consists of a basic segment of a regular configuration, and the aforementioned basic segment and the variant segment which differs in a configuration. the aforementioned basic segment It has the shape of U character which has the turn section. to one side of the shaft-orientations end face of the aforementioned stator core The 1st coil and group of the aforementioned segment which come to arrange the turn section are formed. The 2nd coil and group of the aforementioned segment which join an edge and come to form two or more adjacent layer coil ends are formed so that a lap winding may be formed in another side of the shaft-orientations end face of the aforementioned stator core. The coil which arranges the aforementioned basic segment into a slot regularly, and carries out the surroundings of the aforementioned stator core 2 round is formed, and the aforementioned basic segment is a variant segment from which a configuration differs. It is the stator of the AC generator for vehicles characterized by constituting the turn section which connects the 2nd round with the 1st round with the leader line of the aforementioned stator winding.

[0023] A claim 2 is the stator of the AC generator for vehicles according to claim 1 which arranges the 1st coil of the above, and a group so that the turn section of other segments may surround the turn section of the segment of 1, and is characterized by the bird clapper.

[0024] A claim 3 is the stator of the AC generator for vehicles according to claim 1 or 2 characterized by arranging even electric conductors which make four the minimum only in the direction of a path into the aforementioned slot.

[0025] It is the stator of the AC generator for vehicles according to claim 3 characterized by arranging the joint [in / the 2nd coil of the above, and a group / in a claim 4] annular / four-fold / 3-fold / a duplex and / and].

[0026]

[Embodiments of the Invention] Hereafter, the AC generator for vehicles of this invention is explained based on each example shown in drawing.

The [first operation form] Drawing 1 to drawing 7 is what showed the first operation form of this invention, and drawing 2 to the principal part cross section of the AC generator for vehicles and drawing 6 of drawing 1 are explanatory drawings of the stator of this operation form.

[0027] AC generator 1 for vehicles is equipped with the stator 2 which works as an armature, the rotator 3 which works as a field, the housing 4 which supports a stator 2 and a rotator 3, and the rectifier 5 which changes ac power into a direct current power, and is constituted.

[0028] It rotates united with a shaft 6 and the rotator 3 is equipped with the Laon Dell type field core 7, a field coil 8, the slip rings 9 and 10, and cooling fans 11 and 12. A shaft 6 is connected with a pulley 20 and a rotation drive is carried out with the engine for a run (not shown) carried in the automobile.

[0029] The Laon Dell type field core 7 is constituted combining the field core of a lot. The Laon Dell type field core 7 is constituted from ends of the **** boss section 71 with a group, and the boss section 71 by the shaft 6 by the disk section 72 prolonged in the direction of a path, and the 12 presser-foot-stitch-tongue-like magnetic pole sections 73.

[0030] the shaft-orientations end face of housing 4 -- inhalation -- the hole 41 is formed And corresponding to the 1st coil of a stator 2, group 31a and the 2nd coil, and the direction outside of a path with group 31b, the discharge hole 42 of the cooling style is formed in the periphery both-shoulders section of housing 4.

[0031] A stator 2 is constituted by a stator core 32, the stator winding constituted with two or more electric conductors arranged in the slot 35 formed in the stator core 32, and the insulator 34 which carries out electric insulation of between a stator core 32 and electric conductors.

[0032] It is the perspective diagram showing the typical configuration of a segment 33 where the partial cross section of a stator 2 is equipped with drawing 2 , and a stator core 32 is equipped with drawing 3 . As shown in drawing 2 , two or more slots 35 are formed in the stator core 32 so that the stator winding of a polyphase can be held. With this operation form, corresponding to the number of magnetic poles of a rotator 3, 36 slots 35 are arranged at equal intervals so that the stator winding of a three phase circuit may be held.

[0033] The stator winding with which the slot 35 of a stator core 32 was equipped can be grasped as 1 one electric conductor, and even electric conductors (this operation form 4) are held in each of two or more slots 35. Moreover, four electric conductors in the slot of 1 are arranged by the single tier from the inside about the direction of a path of a stator core 32 in order of inner ****, the inner middle lamella, the outside middle lamella, and the outer edge layer. A stator winding is formed by connecting these electric conductors by the predetermined pattern. In addition, with this operation form, when an end arranges a successive line in the coil and the section of ends of a stator core 32 in the electric conductor within a slot 35, the other end is connected by junction.

[0034] One electric conductor in each slot is making other one electric conductor in a slot besides a predetermined pole pitch remote, and the pair.

[0035] In order to secure, and to arrange in line the crevice between two or more electric conductors which can be especially set in a coil and the section, the electric conductor of the predetermined layer within the slot of 1 is making the electric conductor of other layers within a slot besides a predetermined pole pitch remote, and the pair.

[0036] For example, electric conductor 331a of inner **** within the slot of 1 is making electric conductor 331b of the outer edge layer within a slot besides 1 pole-pitch remote, and the pair towards the direction of a clockwise rotation of a stator core 32. Similarly, electric conductor 332a of an inner middle lamella within the slot of 1 is making medium-rise electric conductor 332b and the pair the outside within a slot besides 1 pole-pitch remote towards the direction of a clockwise rotation of a stator core 32.

[0037] And the electric conductor which makes these pairs is connected by going via the turn sections 331c and 332c by using a successive line in one edge of the shaft orientations of a stator core 32.

[0038] Therefore, in one edge of a stator core 32, the successive line which connects the electric conductor of an outer edge layer and the electric conductor of inner **** will surround the successive line which connects the electric conductor of an outside middle lamella, and the electric conductor of an inner middle lamella. Thus, the connection of an electric conductor which makes a pair is surrounded in one edge of a stator core 32 by the connection of an electric conductor which makes other pairs held in the same slot. A medium-rise coil end is formed of connection in the electric conductor of an outside middle lamella, and the electric conductor of an inner middle lamella, and a **** coil

end is formed of connection in the electric conductor of an outer edge layer, and the electric conductor of inner ****. [0039] electric conductor 332a of the inner middle lamella within the slot of 1 on the other hand -- the direction of a clockwise rotation of a stator core 32 -- turning -- electric conductor 331a' of inner **** within 1 pole-pitch remote and other slots **** -- the pair is made Similarly, it is electric conductor 331b' of the outer edge layer within the slot of 1. Medium-rise electric conductor 332b and the pair are made the outside within a slot besides 1 pole-pitch remote towards the direction of a clockwise rotation of a stator core 32. And these electric conductors are connected by junction in the other-end section of the shaft orientations of a stator core 32.

[0040] Therefore, in the other-end section of a stator core 32, the joint which connects the joint which connects the electric conductor of an outer edge layer and the electric conductor of an outside middle lamella, and the electric conductor of inner **** and the electric conductor of an inner middle lamella is located in a line in the direction of a path. An adjacent layer coil end is formed of the connection between the electric conductor of an outer edge layer, and the electric conductor of an outside middle lamella, and connection between the electric conductor of inner ****, and the electric conductor of an inner middle lamella.

[0041] Thus, in the other-end section of a stator core 32, without overlapping, it arranges and the connection of an electric conductor which makes a pair is arranged.

[0042] Furthermore, two or more electric conductors are offered by the segment which fabricated the electric conductor with the straight angle cross section in the predetermined configuration. It is provided by the large segment 331 which the electric conductor of inner **** and the electric conductor of an outer edge layer fabricate a series of electric conductors in the shape of about U characters, and become so that it may be illustrated by drawing 3 . And the electric conductor of an inner middle lamella and the electric conductor of an outside middle lamella are offered by the small segment 332 which comes to fabricate a series of electric conductors in the shape of about U characters.

[0043] The large segment 331 and the small segment 332 form a basic segment 33. And a basic segment 33 is regularly arranged into a slot 35, and the coil which carries out the surroundings of a stator core 32 2 round is formed. However, the turn section which connects the segment which constitutes the leader line of a stator winding and the 1st round, and the 2nd round consists of variant segments from which a basic segment 33 differs in a configuration. And in the case of this operation form, the number of a variant segment becomes three. Although the connection between the 1st round and the 2nd round turns into **** and medium-rise connection, a variant coil end is formed of this connection.

[0044] About X phase which is one phase of the three-phase-circuit coils, a coil specification view is explained using drawing 4 , drawing 5 , and drawing 6 . A solid line shows a dashed line and an inner middle lamella, and a two-dot chain line shows [an outer edge layer] inner **** for a dashed line and an outside middle lamella. Moreover, an upper case is the 1st coil and group 31a which come to arrange the turn section, and the lower berth is the 2nd coil and group 31b which come to arrange a joint. Moreover, the number located in a line in the center of drawing at a horizontal single tier expresses the slot number, and is the same also in other coil specification views.

[0045] First, as shown in drawing 4 , a segment 33 is arranged every three slots from No. 1 of the slot number. In the 2nd coil and group 31b, the edge of the electric conductor of an outer edge layer to which the edge of the electric conductor of an outside middle lamella which came out of the slot of 1 came out of the slot besides 1 pole-pitch remote towards the direction of the circumference of a clock of a stator core 32, and the edge of the electric conductor of inner **** which came out of the slot of 1 again are joined to the edge of the electric conductor of an inner middle lamella which came out of the slot besides 1 pole-pitch remote towards the direction of And the 1st coil 311 of the lap winding of 2 turns is formed per slot.

[0046] Similarly, as shown in drawing 5 , the 2nd coil 312 of the lap winding of 2 turns is formed per slot.

[0047] As the coil 311 and coil 312 of these drawing 4 and drawing 5 are shown in drawing 6 , 33m of edges of the 1st coil 311 and 33n of edges of the 2nd coil 312 are connected, and the coil 315 of 4 turns is formed per slot.

[0048] Here, the large segment 311 and the small segment 312 whose segment which has the turn section which connects 33m of edges of the 1st coil 311 and 33n of edges of the 2nd coil 312 is a basic segment 33 differ from each other in the configuration.

[0049] In the coil of this X phase, a variant segment is three of segments which has the segment which has the turn section which connects 33m of edges of the 1st coil 311, and 33n of edges of the 2nd coil 312, the segment which has the coil edge X1, and the coil edge X2. It can explain as follows that a variant segment is stopped by three.

[0050] The 1st coil 311 shown in drawing 4 can be obtained in the annular coil which joins regularly as mentioned above and can be done by cutting turn section 332c of the small segment 332 inserted in the slot 35 of No. 1 and No. 34.

[0051] Similarly, the 2nd coil 312 can be obtained in the annular coil which joins regularly and can be done by cutting turn section 331c of the large segment 331 inserted in the slot 35 of No. 1 and No. 34. And one coil 315 is formed by connecting one side of the cutting section of turn section 331c, and one side of the cutting section of turn section 332c

in series, and using another side of each cutting section as a coil edge. Thus, the coil 315 of the lap winding of 4 turns can be formed by cutting two annular coils by two places, connecting the cutting section of the ring of 1, and the cutting section of other rings, and making it one coil. Therefore, the number of required variant segments is three.

[0052] Moreover, this variant segment can be concentrated and prepared between the 1st coil and 1 pole pitch of group 31a. It is because turn section 331c forms the 1st coil 311 and 332 cc of turn sections forms the 2nd coil 312 with this operation form. Y phase and Z phase are formed in the slot from which a phase differs by a unit of 120 degrees mutually like X phase. The coil edges Y1 and Z1 of the coil edge X1 of X phase and Y phase which is not illustrated, and Z phase are connected to a rectifier 5, and the coil edge X2 is connected with Y2 and Z2 which are not illustrated as the neutral point. And as shown in drawing 7, star connection of these three phase circuits is carried out. In the coil shown in drawing 6, the coil edge X1 connected with a rectifier 5 is taken out from the 1st coil and group 31a side by shaft orientations.

[0053] The manufacturing process of a stator winding is explained below. A basic segment 33 is arranged so that turn section 331c of the U character-like large segment 331 may surround turn section 332c of the U character-like small segment 332, and it is inserted from the one side of the shaft-orientations side of a stator core 32. that time -- one electric conductor 331a of the large segment 331 -- inner **** of the slot of 1 of a stator core 32 -- as for one electric conductor 332a of the small segment 332, the electric conductor of another side of the small segment 332 is also inserted in a clockwise rotation outside a slot besides the above from the slot of the above 1 of a stator core 32 at a middle lamella at the outer edge layer of a slot besides 1 pole-pitch remote, as for electric conductor 331b of another side of the inner middle lamella of the slot of the above

[0054] consequently, it is shown in drawing 2 -- as -- as the electric conductor above-mentioned from an inner **** side to the slot of 1 -- Bays 331a and 332a, 332b', and 331b -- ' It is arranged at a single tier. Here, they are 332b' and 331b'. It is the bay of the electric conductor within a slot besides 1 pole-pitch *****, and the segment of the size which is making the pair.

[0055] In the 2nd coil and group 31b, Joints 331d and 331e are leaned in the direction in which the large segment 331 opens the electric conductor located in a **** side by 1.5 slots after insertion. And Joints 332d and 332e are leaned in the direction in which the small segment 332 closes a medium-rise electric conductor by 1.5 slots.

[0056] The above composition is repeated about the segment 33 of all the slots 35. and the 2nd coil and group 31b -- setting -- joint 331e' of an outer edge layer, joint 332e of an outside middle lamella, 332d of joints of an inner middle lamella, and 331d of joints of inner **** -- ' It is joined by meanses, such as welding, ultrasonic welding, arc welding, and soldering, and connects electrically.

[0057] In addition, this segment is fabricated by the copper monotonous shell, the press, etc. by the abbreviation type configuration for U characters. A large segment and a small segment may be fabricated individually and may fabricate two copper monotonous shells simultaneously. Moreover, a segment twists an electric conductor with a linear straight angle cross section, and is formed. The configuration of the turn section is good also not only as the typeface of KO as shown in drawing 3 but circular.

The [operation effect of the first operation form] By considering as the above-mentioned composition, the electric conductor of each class inclines in the same direction in the 1st coil, group 31a, the 2nd coil, and group 31b. Therefore, the coil 315 of the lap winding of 4 turns can be formed per slot, without the segments of the same layer interfering. At this time, a variant segment requires only three per one phase, and all others can constitute the coil of a lap winding from arrangement of a basic segment 33.

[0058] Moreover, a joint can be arranged with the 2nd coil and group 31b, and workability can be improved. On the other hand, many joints can be arranged at equal intervals annularly [a duplex]. Therefore, proximity of the distance between joints can be suppressed and junction processes, such as welding, can be made easy. For example, improvement in productivity is possible for positioning of welding equipment, the alignment to a part welding, etc. becoming easy etc.

[0059] Furthermore, since it is also possible that both are arranged and it can introduce into a slot simultaneously since the double turn section is formed so that the large segment 331 may surround the small segment 332, or to manufacture both simultaneously in the fabricating operation of the turn section, a segment 33 can raise productivity more.

[0060] Moreover, productivity can be improved also by preparing the variant segment used as an irregular configuration in the portion concentrated between the 1st coil and 1 pole pitch of 31a.

[0061] By the above, in the stator which used the segment, the productivity of segment manufacture and a coil process can be raised, and a manufacturing cost can be reduced.

The [second operation form] The 1st operation form showed the coil 315 of four turns per slot. However, according to the output characteristics as which vehicles are required, demand of wanting to make [many] the number of electric conductors per slot can be carried out like the following operation form [the 2nd to 4th], and can be realized.

[0062] Although the first operation form showed the structure of the coil which made the number of electric conductors per slot four, the laminating of the coil 316 which made four the unit for the number of electric conductors per slot can be carried out in the direction of a path of a coil 315. The coil of two or more 4 turns formed in the slot of 1 of this is connectable in series.

[0063] The 1st coil in case the number of electric conductors per slot is eight, and the typical cross section of group 31a are shown in drawing 8, and the coil specification view for one phase is shown in drawing 9 and drawing 10. Drawing 9 expresses the coil formed by four layers from an outer edge layer side, a solid line shows a dashed line and the 3rd layer, and a two-dot chain line shows [an outer edge layer side to the 1st layer] the 4th layer for a dashed line and the 2nd layer. Moreover, drawing 10 expresses the coil formed by the 8th layer from the 5th layer, a solid line shows a dashed line and the 7th layer, and a two-dot chain line shows [an outer edge layer side to the 5th layer] the 8th layer for a dashed line and the 6th layer. The coil of drawing 9 and the coil of drawing 10 are formed like the first operation form. And the coil of drawing 9 and drawing 10 is connected in series by arranging one segment with the turn section which connects the coil edge XX1 and the coil edge XX2.

[0064] A joint can be arranged with the 2nd coil and group 31b also in this case, and workability can be improved. On the other hand, many joints can be arranged at intervals [annular / four-fold]. Therefore, the productivity of a junction process as well as the first operation form is securable. Moreover, although five variant segments per one phase are needed with this operation form, those variant segments can be centralized between the 1st coil and 1 pole pitch of group 31a like the first operation form.

The [third operation form] Although the first operation form showed the structure of the coil 315 which made the number of electric conductors per slot four, you may arrange the turn section of a segment so that a coil 315 may be surrounded by the coil 317 by the 1st coil and group 31a multiplex considering the number of electric conductors per slot as a case of the multiple of 4.

[0065] In this case, two or more the same coils as the first operation form are formed combining every two the 2 and inner **** side by the side of an outer edge layer adjoins further two one by one, and these are connected in series. the conductor per slot -- the 1st coil in case a number is eight, and the typical cross section of group 31a -- drawing 11 -- moreover, the coil specification view for one phase is shown in drawing 12 and drawing 13. Drawing 12 shows the 3rd layer to 6th-layer composition among the 1st layer to the 8th layer, and drawing 13 shows the 1st layer, the 2nd layer, the 7th layer, and 8th-layer composition.

[0066] In drawing 12, a solid line shows a dashed line and the 5th layer, and a two-dot chain line shows [an outer edge layer side to the 3rd layer] the 6th layer for a dashed line and the 4th layer. Moreover, in drawing 13, a solid line shows a dashed line and the 7th layer, and a two-dot chain line shows [an outer edge layer side to the 1st layer] the 8th layer for a dashed line and the 2nd layer. The coil of drawing 9 and the coil of drawing 10 are formed like the first operation form. The coil of drawing 12 and drawing 13 is connected in series by arranging one segment with the turn section which connects the coil edge XX3 of drawing 12, and the coil edge XX4 of drawing 13.

[0067] By the above, a joint can be arranged with the 2nd coil and group 31b, and workability can be improved. On the other hand, many joints can be arranged at intervals [annular / four-fold]. Therefore, the productivity of a junction process as well as the first operation form is securable. moreover -- although five variant segments per one phase are needed also in this operation form -- the [the first operation form and] -- those variant segments can be centralized between the 1st coil and 1 pole pitch of group 31a like 2 operation forms

The [fourth operation form] Although the first operation form showed the structure of the stator winding which made the number of electric conductors per slot four, it is good also as structure where make the number of electric conductors per slot into six, arrange the small segments 332 and 333 of the shape of 2 character [U] in the direction of a path at one coil end, and one large segment 331 surrounds them.

[0068] Drawing 14 is the 1st coil and the typical cross section of group 31a, and may be the 1st layer, the 2nd layer, the 3rd layer, the 4th layer, the 5th layer, and the 6th layer from an outer edge layer side. They are ****331a and 331b' at the 1st layer and the 6th layer. It forms and they are medium-rise 332a and 332b' at the 2nd layer and the 3rd layer. And the 4th layer, medium-rise 333a of others [the 5th layer], and 333b' It forms. The turn section which connects between outer edge layers is formed of the 1st layer and the 6th layer, and the turn section which connects the 2nd layer, the 3rd layer and the 4th layer, and the 5th layer with the inside is arranged. A coil specification view is shown in drawing 15 and drawing 16 by making a part for one phase into the example of representation.

[0069] In drawing 15 and drawing 16, a narrow solid line shows a narrow dashed line and the 3rd layer, and a two-dot chain line, a dashed line thick the 5th layer, and a solid line thick the 6th layer show [an outer edge layer side to the 1st layer] the 4th layer for a dashed line and the 2nd layer. The 2nd coil 314 shown in the 1st coil 313 shown in drawing 15 and drawing 16 forms the coil of the lap winding of 3 turns per slot. The coil of drawing 15 and drawing 16 is connected in series by arranging one segment with the turn section which connects the coil edge XX5 of the 1st coil

313, and the coil edge XX6 of the 2nd coil 314.

[0070] Also in this case, a joint can be arranged with the 2nd coil and group 31b, and workability can be improved so that more clearly than a coil specification view. On the other hand, in many joints, since [three-fold] it can arrange at equal intervals annularly, the productivity of a junction process as well as the first operation form can be improved.

[0071] Moreover, with this operation form, the variant segment per one phase is three of a segment have the segment which has the connection of the edge XX5 of the 1st coil 313, and the edge XX6 of the 2nd coil 314, the segment which has the coil edge X1, and the coil edge X2. Moreover, a variant segment can be centralized between the 1st coil and 1 pole pitch of group 31a like the third operation form from the first operation form.

[Other operation forms] In the first operation form, the variant segment which connects the 1st coil 311 and the 2nd coil 322 was considered as connection of inner **** and an outside middle lamella, and made the leader line the outer edge layer and the inner middle lamella. However, the variant segment which connects the 1st coil 311 and the 2nd coil 322 is considered as connection of an outer edge layer and an inner middle lamella, and is good also considering inner **** and an outside middle lamella as a leader line.

[0072] Moreover, in the first operation form, the configuration of a basic segment 33 was made into the shape of U character to which turn section 331c of the large segment 331 surrounds turn section 332c of the small segment 332 in one coil end. However, a cylindrical segment may be inserted in a slot 35 and the portion which had connected using the successive line via the turn section in the first operation form may be connected by junction. In this case, in both coil ends, junction connects and an electric conductor forms an electric coil. And in one coil end, the joint is located together with annular [by the side of a inner layer and an outer layer / two-layer], and in the coil end of another side, it is located so that the joint of the electric conductor of an outer edge layer and the electric conductor of inner **** may surround the joint of the electric conductor of an outside middle lamella, and the electric conductor of an inner middle lamella.

[0073] Moreover, in one coil end, the joint of the electric conductor of an outer edge layer and the electric conductor of inner **** surrounds the joint of the electric conductor of an outside middle lamella, and the electric conductor of an inner middle lamella, and it is good in the coil end of another side also as composition which connected the electric conductor of an outer edge layer, the electric conductor of an outside middle lamella and the electric conductor of inner ****, and the electric conductor of an inner middle lamella by the successive line.

[0074] In addition, although the leader line was formed in the 1st coil and group 31a side with the fourth operation form from the above first, you may form a leader line in the 2nd coil and group 31b which are a joint side.

[0075] the fourth operation form -- a conductor -- although the number carried out to six -- a conductor -- when a number is $6+4N$ s (N : natural number), inner **** and an outer edge layer are connected in the turn section, and others can apply the same coil structure, if the layer located in a line in the direction of a path is connected in the turn section

[0076] Although a rotator 3 has the presser-foot-stitch-tongue-like magnetic pole of 12 poles and the slot of a stator 2 is made into 36 pieces with the above-mentioned operation form, when a pole is changed and the number of slots is changed in connection with it, the coil structure of the same form can be applied. For example, the number of slots may be made into double precision, two three phase coil groups may be formed, and these outputs may be compounded.

[0077] Moreover, although they are connected and one coil is formed when there are two or more coils which go a slot around, the combination of those connection is arbitrary. That is, according to the output characteristics demanded from vehicles, a series connection, parallel connection, or compound connection in parallel with a serial is sufficient.

Drawing 17 shows compound connection in parallel with a serial. In for example, the operation form and the second operation form which formed the coil of 8 turns per slot, drawing 17 formed 33m of edges of the 1st coil 311, and 33n of edges of the 2nd coil using the respectively cylindrical segment, and has connected these 1st coils 311 and the 2nd coil 322 in parallel. And it is connected with the coil for other four turns at a serial, and the coil of each phase is formed by considering those ends as an output.

[0078] Moreover, after making 2 sets of coils of star connection and changing into a direct current with each rectifier when forming the coil of each of each two phases as shown in drawing 18 , you may compound dc output.

[0079] Although the above-mentioned operation form showed the case where the number of slots was 36, the number of slots can form a coil similarly in the operation form which doubled. A circuit diagram when the number of slots doubles is shown in drawing 19 . In the example shown in drawing 19 , a coil which is different 30 degrees by the electrical angle in each other is formed like the above-mentioned operation form, they are connected in series and each coil of X phase, Y phase, and Z phase is formed. Moreover, after carrying out star connection of each of a coil which is different 30 degrees by the electrical angle to each other and changing into a direct current with each rectifier, you may compound dc output. In addition, the same coil can be formed when a slot is set as 3 or more times.

[0080] In addition, with the above-mentioned operation form, although the stator winding carried out star connection of X phase, Y phase, and the Z phase and formed them, delta connection of X phase, Y phase, and the Z phase may be

carried out, and it may form them. Or when compounding the dc output after rectification using two or more rectifiers, you may combine star connection and delta connection.

[0081] moreover, the number of variant segments -- the number of the circumference of a stator core -- 1 -- since it becomes many numbers -- the [the first operation form and] -- the number of a coil like the coils 311, 312, 313, and 314 which go around a slot which was explained with 4 operation forms -- 1 -- only many numbers are needed The number of a variant segment can be stopped maintaining the number of turns, since the above-mentioned coils 311, 312, 313, and 314 are coils of two or more turns per 1 round of stator cores.

[0082] Moreover, although the segment used the thing of a straight angle cross section with the above-mentioned operation form, a wire cross section is [that the bays 331a, 331b, 332a, and 332b held in a slot at least should just be straight angle cross sections] sufficient as other portions.

[Translation done.]

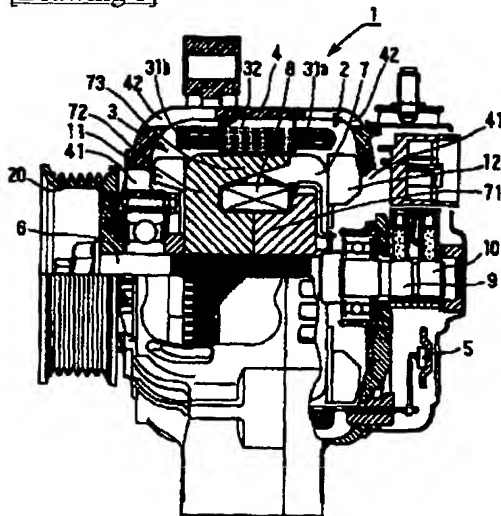
* NOTICES *

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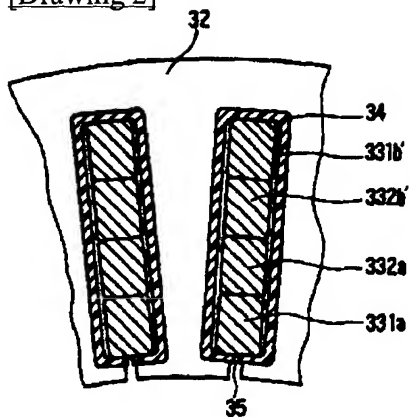
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

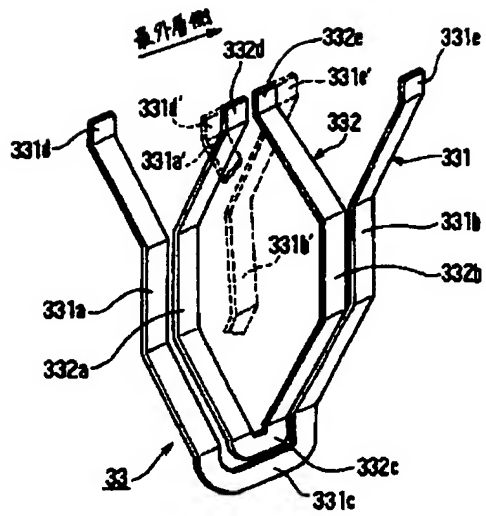
[Drawing 1]



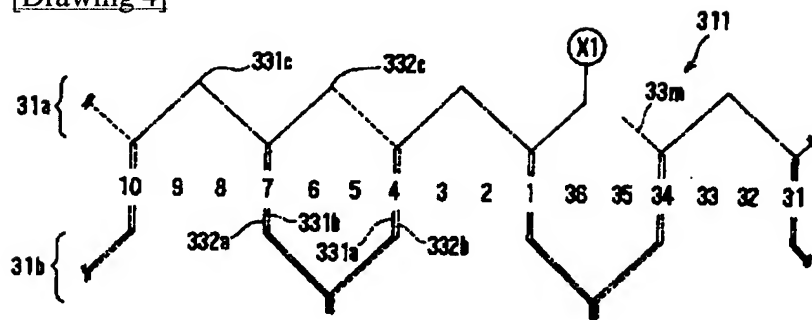
[Drawing 2]



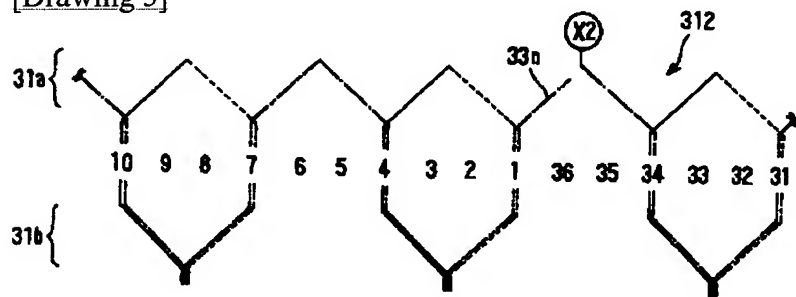
[Drawing 3]



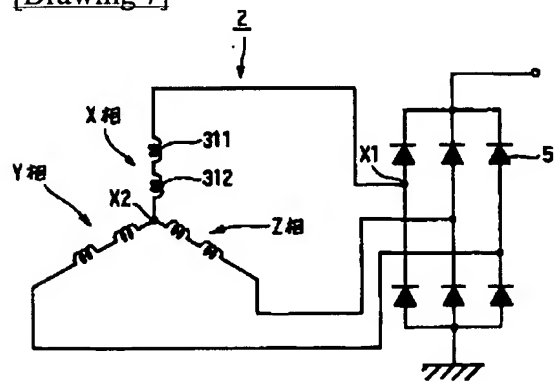
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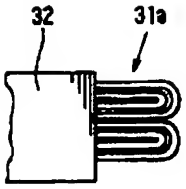
[Drawing 5]



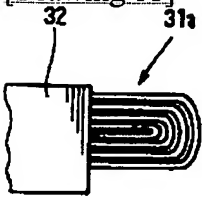
[Drawing 7]



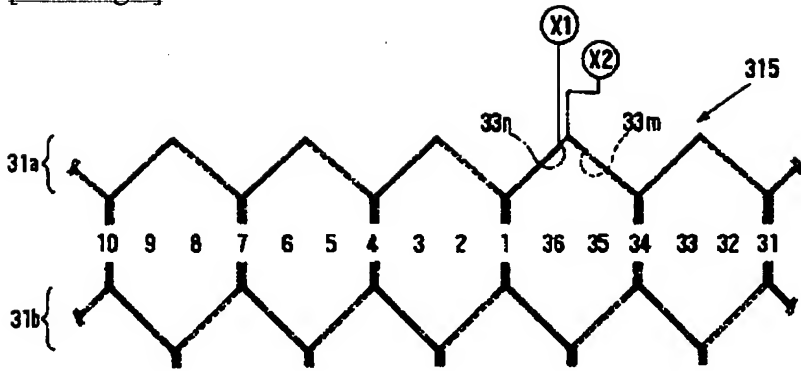
[Drawing 8]



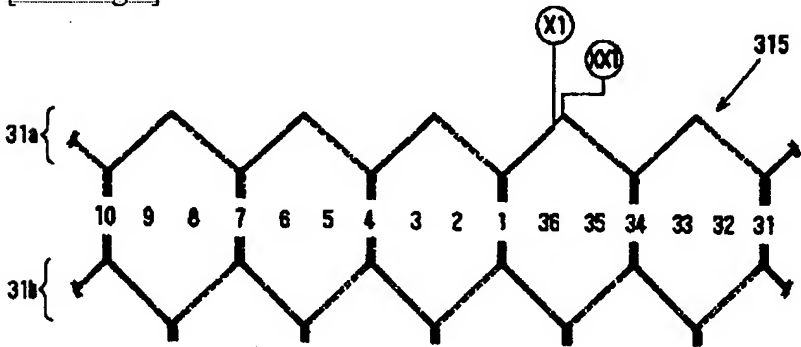
[Drawing 11]



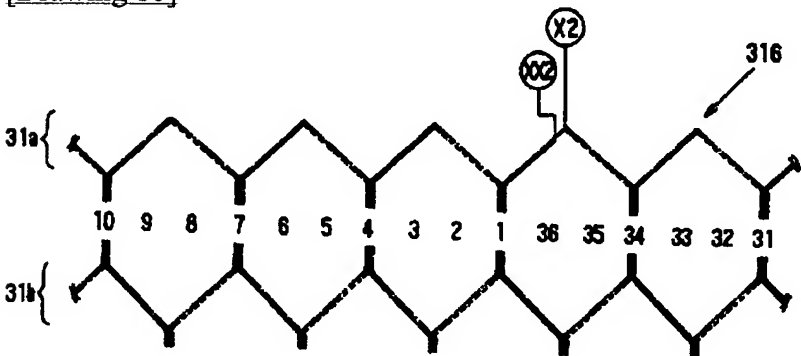
[Drawing 6]



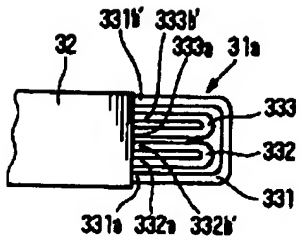
[Drawing 9]



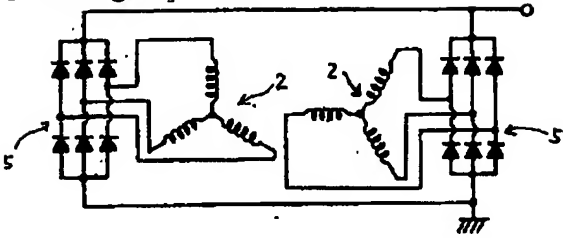
[Drawing 10]



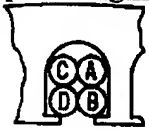
[Drawing 14]



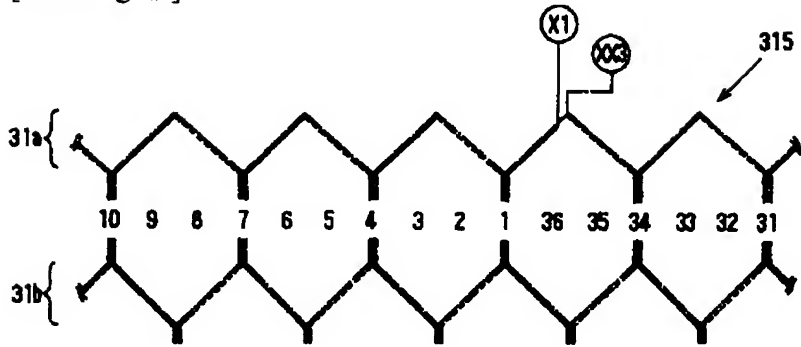
[Drawing 18]



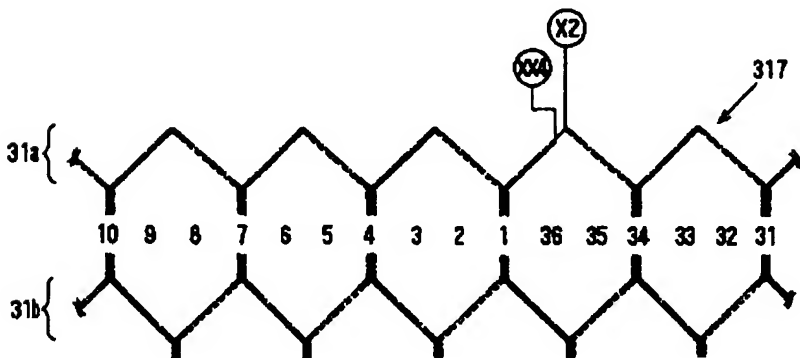
[Drawing 21]



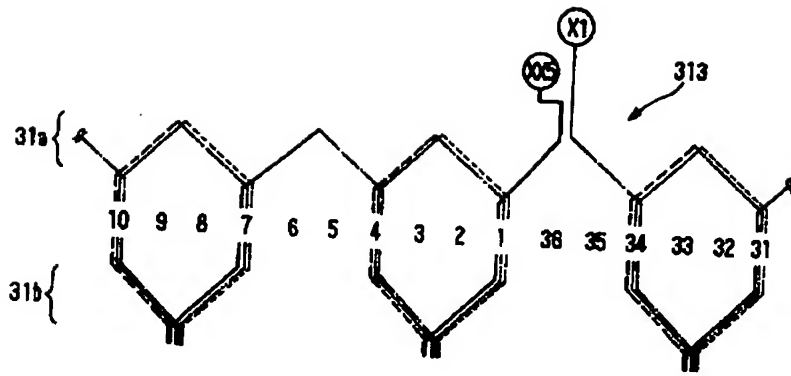
[Drawing 12]



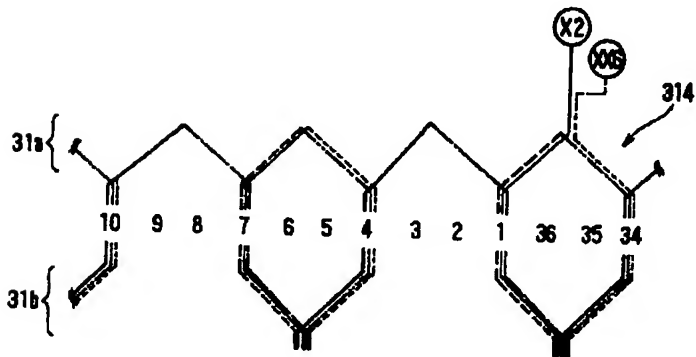
[Drawing 13]



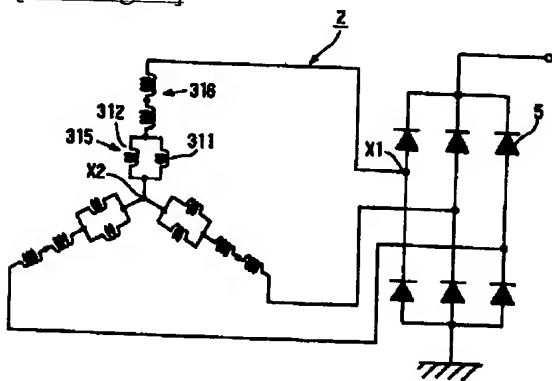
[Drawing 15]



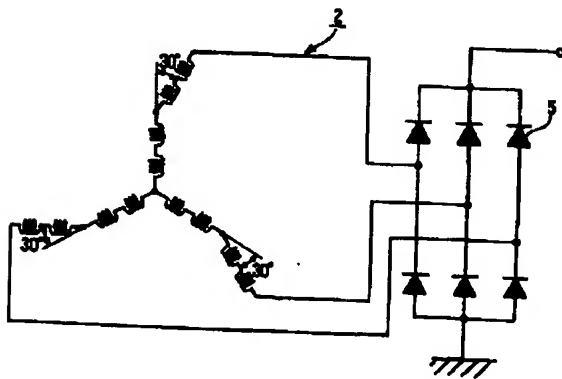
[Drawing 16]



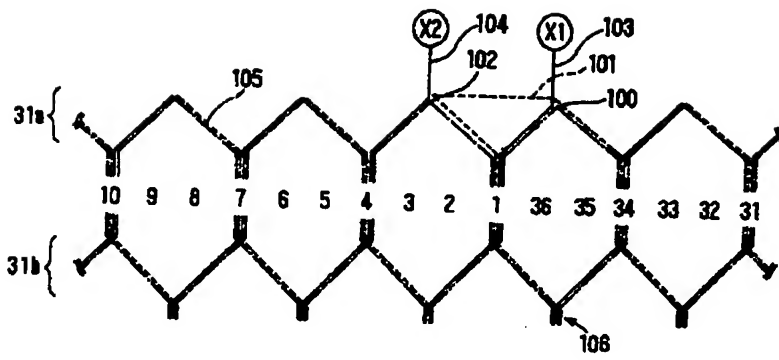
[Drawing 17]



[Drawing 19]



[Drawing 20]



[Translation done.]